



# SIR C. V. RAMAN

A SHORT BIOGRAPHICAL SKETCH

BY

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## PREFACE

THE year 1938 marks the tenth year of the discovery of the Raman Effect and also coincides with the fiftieth year of age of its discoverer, Sir C. V Raman. It is, therefore, a fitting occasion to give a short biographical sketch of the great scientist and briefly review the various investigations to which he devoted himself before and after his capital discovery. A list of the scientific papers published by him and his numerous pupils forms an Appendix to this sketch.

BANGALORE,  
*1st February 1938.* }

P. KRISHNAMURTI.



# SIR C. V. RAMAN

## A SHORT BIOGRAPHICAL SKETCH

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### I

SIR (CHANDRASEKHARA) VENKATA RAMAN was born at Trichinopoly in South India on the 7th November 1888. His father Ramanatha Chandrasekharan was at that time a teacher in the S P G. College, Trichinopoly. When Raman was four years old, his father moved to Vizagapatam to join a post as Lecturer in Physics at Mrs A. V. N. College. The next ten years of Venkata Raman's life were spent at Vizagapatam, where he received his early education. In January 1903, he joined the Presidency College at Madras, to study for his University degrees. He passed his B.A. Examination in 1904, winning the first place and Gold Medal in Physics, and the M.A. Examination in January 1907, obtaining a First Class and record marks. While still a student at the Presidency College, he ventured on his own initiative to engage in independent research work. Raman's first paper was on the diffraction bands observed when light is reflected very obliquely at the face of a prism. It was published in the *Philosophical Magazine of London* in November 1906.

At that time, the only superior service which was open to Indians of ability and which did not require a stay in Europe was the Indian Finance Department. Not seeing any possibility of a scientific career, Raman, on the advice of his College Professors decided to sit for the competitive examination of the department held in February 1907. Here again he secured the first place, and joined the service as Assistant Accountant-General at Calcutta in June 1907, when he was a little over eighteen years old.

## II

THE next ten years of his life were spent as an Officer of the Finance Department. Though the duties of his office took most of his time, Raman found opportunities for carrying on experimental research in the laboratory of the Indian Association for the Cultivation of Science at Calcutta. Later, when he was transferred first to Rangoon and thence to Nagpur, Raman continued his investigations, converting a part of his house into a laboratory and working with improvised apparatus. Fortunately, he was transferred back to Calcutta in November 1911 and could thus work again at the laboratory of the Association. The equipment at Raman's disposal during these early years was of a rather primitive character. Nevertheless it sufficed to enable him to pursue some of the topics in which he was interested and to publish a series

of significant researches on the subject of vibrations, sound and the physical theory of musical instruments.

Raman's success in research attracted the attention of the late Sir Asutosh Mookerjee, then Vice-Chancellor of the Calcutta University. When Sir Asutosh wanted a Professor capable of filling the newly endowed Palit Chair of Physics, he thought of Raman and offered him the post. Although Raman knew that from a pecuniary point of view he would be a great loser, he did not hesitate to accept the offer. He left Government service in July 1917 and joined the University of Calcutta as Palit Professor of Physics. In 1919, he was also elected as Honorary Secretary of the Indian Association for the Cultivation of Science, a position which gave him control of the resources of this institution and proved to be of great importance for the development of his scientific activities.

### III

RAMAN's whole time was now available for scientific work, and for the first four years of his tenure as Professor, he devoted his energies mainly to organising a school of research and giving a lead to the young men who gathered round him at the University College of Science and at the Indian Association for the Cultivation of Science. The investigations of these years lay mostly in the field of optical theory and experiment, including



especially the diffraction of waves by obstacles of various forms and the propagation of light in diffusing media. Numerous memoirs dealing with these topics were published by the workers in Raman's laboratory who thus received their first training in scientific research and thereby laid the foundation for their subsequent careers of life.

The summer of the year 1921 saw a fresh impetus given to Raman's work. At the pressing request of Sir Asutosh Mookerjee, he made his first brief visit to Europe as a delegate to the Universities Congress held that year at Oxford. During his voyage out, Raman's attention was attracted to the problem of the origin of the blue colour of the Mediterranean, and he conceived the idea that the molecular scattering of light in water was the primary origin of the colour of the deep sea. Observations during the return voyage afforded confirmation of this hypothesis and furnished the inspiration for a comprehensive programme of research which he undertook on the molecular scattering of light in solid liquid and gaseous media. The laboratory of the Indian Association for the Cultivation of Science, with its facilities steadily improving under Raman's administration, became the natural centre of this new activity. The assistance given by a succession of gifted collaborators who were attracted to this laboratory from all parts of India, enabled Raman to push forward

steadily with his investigations. Not only did the studies on the molecular scattering of light prove most fruitful in themselves, but they also suggested and inspired numerous researches in related topics in many branches of Physics.

#### IV

EARLY in 1928, the work of the preceding seven years on the molecular scattering of light at Calcutta found its natural culmination and reward in the discovery of the new phenomenon which when announced was acclaimed everywhere as the "Raman Effect". In his lecture of March 1928 describing the new radiation effect, Raman made it clear that this discovery had not only opened up a new branch of spectroscopy, but that the results of its application would prove to be of great significance for Physics and Chemistry generally. These anticipations were soon amply fulfilled, as many investigators in all parts of the world entered the new field of research and by their contributions extended it rapidly in various directions. Investigations on the Raman Effect naturally formed a considerable part of the activities of the laboratory where it was discovered, and many significant contributions were made to the subject by the Calcutta workers in the following five years. But the subject did not by any means monopolize Raman's attention, as will be seen from the fact that numerous memoirs on X-Ray diffraction,

magneto-optics, magne-crystallic action, and crystal structure also emerged from his laboratory during these years

## V

IN April 1933, Raman accepted a call to the Indian Institute of Science at Bangalore. This Institute which was founded in 1909 to promote scientific research for the benefit of India, possessed departments of Chemistry and Engineering, but had none for Mathematics or Physics and thus lacked the intellectual atmosphere necessary for the growth of scientific research. Undeterred by this fact and the earlier chequered history of the Institute, Raman took up its direction in the hope of being able to change the outlook of the Institute and making it the chief centre of science in India. The opposition of vested interests, financial difficulties, and the decision of the authorities that the resources of the Institute should be devoted to "industrial research" in preference to fundamental scientific investigations have prevented Raman's aims from being achieved. Nevertheless, in a little over four years, much useful progress has been made. A new department of Physics has been created and equipped with modern apparatus. A precision workshop has been organised, in which scientific instruments of all kinds required for research have been successfully manufactured. The Indian Academy of Sciences has

been established with its headquarters at Bangalore, and its work and publications have been developed so as to secure world-wide recognition. Finally, an active school of Physics has been created which in a short space of time has done much useful work in diverse fields, such as colloid research, ultrasonics, spectroscopy and theory of the solid state.

## VI

THE success of Raman's work as a teacher and investigator has received world-wide recognition. The Royal Society of London elected him to its Fellowship in 1924. The British Government conferred a Knighthood on him in 1929. He received the Nobel Prize for Physics in 1930. Amongst other notable scientific honours may be mentioned, the award of the Matteucci Medal by the "Società Italiana della Scienze" of Rome in 1928 and of the Hughes Medal of the Royal Society of London in 1930. He received, *honoris causa*, the Ph.D. Degree of the University of Freiburg and the LL.D. of Glasgow University in 1930 and the Sc.D. of the University of Paris in 1932. The Universities of Calcutta, Bombay, Madras, Benares and Dacca in India have also conferred honorary doctorates on him. He is an Honorary Member of the Deutsche Akademie of Munich, of the Zurich Physical Society, the Royal Philosophical Society of Glasgow, the Royal Irish Academy and of the Hungarian Academy of Sciences. Amongst the

Indian distinctions he has received should be mentioned specially the title and decoration of "Rajasabhabhushana" conferred by the Maharaja of Mysore in 1935. He is an Honorary Member of the Indian Mathematical Society, of the Indian Chemical Society, and of the Indian Science Congress Association as also of several local organisations. He was General President of the Indian Science Congress in 1929, and has been President of the Indian Academy of Sciences since its foundation in 1934.

## VII

WELL over a hundred young men—mathematicians, physicists, chemists and geologists—have had their first training in research under Raman. Most of these had some published work to their credit before they left his laboratory, usually in their own names and with an acknowledgement of the guidance received from him. A bibliography of the publications issued from Raman's laboratory at Calcutta and Bangalore would cover a dozen branches of Physics and would include over six hundred titles of papers. But such a bibliography would not by itself convey a sufficient idea of the influence—direct and indirect—which Raman has exercised on the promotion of science in India. Many of his past pupils occupy important positions all over the country as Professors, Readers or Lecturers in the Universities and Colleges, or as members of the scientific services under the

Imperial and Provincial Governments Not a few of them are following up the lines of research with which they first obtained familiarity in Raman's laboratory. Further, there is scarcely a University in India which has not, in the past, invited Raman to give courses of lectures on recent advances in science. These lectures, the influence of the scientific periodicals established and edited by him, namely *The Indian Journal of Physics* and the *Proceedings of the Indian Academy of Sciences*, and the activities of the Indian Science Congress of which Raman was the leading spirit for many years, have been in no small measure responsible for the growth of a scientific atmosphere in India during the past quarter of a century.

### VIII

No sketch, however brief, of Raman's career can omit a mention of his travels outside India which have afforded him opportunities of visiting the leading research laboratories and of cultivating personal relations with the leaders of science in Europe and America. A reference has already been made to his first visit to Europe in 1921. In 1924, he was invited to Great Britain to join the British Association for the Advancement of Science in a tour across Canada and was requested to open a discussion on the Scattering of Light at the Toronto meeting of the British Association and of the International Congress of Mathematicians.

Following this meeting, Raman visited the United States to represent India at the Centenary of the Franklin Institute at Philadelphia. At the invitation of R. A. Millikan, he spent four months at Pasadena as a Visiting Professor at the California Institute of Technology, before returning to India early in 1925. In the autumn of 1925, Raman again visited Europe as the guest of the Russian Academy of Sciences to represent India at the Bicentenary celebrations of the Academy in Leningrad and Moscow. In 1929, Raman was invited by the Faraday Society to open a discussion on molecular spectra at Bristol, and took the opportunity of visiting and lecturing at many centres of learning in Europe. He subsequently visited Europe in the winter of 1930 to receive the Nobel Prize at Stockholm; in 1932, to receive the honorary doctorate at Paris, and in 1937, as an invitee to take part in the International Congresses of Physics at Paris and Bologna. On each occasion he visited many of the leading centres of research and renewed his personal contacts with the scientists of Europe.

## IX

RAMAN's longer publications include two memoirs on the maintenance of vibrations published as Bulletins 6 and 11 of the Indian Association for the Cultivation of Science in 1912 and 1914 respectively, a memoir on the mechanical theory of

bowed stringed instruments published as Bulletin No 16 of the Association in 1928, an essay on the molecular diffraction of light published by the Calcutta University Press in 1922, and an article on the physics of musical instruments contributed to Volume 8 of Springer's *Handbuch der Physik* in 1927. Raman's lecture describing the new radiation effect discovered by him was published in the *Indian Journal of Physics* in March 1928. Prior to this year, Raman and his pupils frequently contributed to the *Philosophical Magazine of London*, the *Physical Review*, the *Proceedings of the Royal Society of London* and the *Astro-Physical Journal*. Since 1928, however, the papers from the school have appeared almost exclusively in the *Indian Journal of Physics* and more recently, in the *Proceedings of the Indian Academy of Sciences*. Raman has, however, been a constant contributor for many years to the correspondence columns of *Nature*, which have contained the first announcements of many new facts and ideas in diverse fields of research emerging from his laboratory. Each of these brief communications has often been the starting point of a long series of detailed papers by himself and his collaborators.

Side by side with experimental work, many investigations of a theoretical character figure in the list of Raman's publications. As instances, may be mentioned, the series of papers on the



molecular theory of the scattering of light and of the diffraction of the X-rays in amorphous media (compressed gases, liquids and liquid mixtures) published by Raman and Ramanathan in 1923, the papers on the theory of flow birefringence, on magnetic and electric double refraction, and on the optical and electrical properties of fluids published by Raman and Krishnan in 1927 and 1928, as also the series of five memoirs by Raman and Nagendra Nath on the diffraction of light by ultrasonic waves published in 1935 and 1936

## X

QUITE characteristic of Raman is the intense zeal and enthusiasm for research which students imbibe by association with him. His dynamic personality and untiring energy have made possible the greatest advance in physical science India has witnessed so far. Simple and unostentatious, he is easily available to any worker in the laboratory. His subject is to him all-engrossing—all other things are relegated to the background.

Raman's exposition of any subject is most impressive. He starts from fundamentals and builds up as he goes along in a masterly way. His popular lectures on scientific subjects, always delivered *extempore*, attract huge audiences and are listened to with rapt attention. His talks are most interesting and enlivening. In him one finds the rare combination of a successful speaker and scientist.

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85. DR. S. VENKATESWARAN, Examiner of Patents Patent Office, *Calcutta*.

## Bibliography of Published Papers

	Subjects	Number of Titles
1.	Vibrations and Sound . . .	31
2.	Theory of Musical Instruments . .	34
3.	Wave-Optics . . .	66
4.	Colloid Studies . . .	35
5.	Molecular Scattering of Light . .	70
6.	X-Rays and Electron Diffraction	50
7.	Magnetism and Magneto-Optics . .	41
8.	Electro-Optics and Dielectric Behaviour .	25
9.	Raman Effect . . .	50
10.	Viscosity of Liquids and Surface Forces .	17
11.	Ultrasonics and Hypersonics . . .	37
12.	Line and Band Spectra . . .	15
13.	Raman Spectra . . .	105
14.	Optical and Elastic Properties of Solids .	20
15.	Miscellaneous . . .	10
GRAND TOTAL . .		627

# 1 VIBRATIONS AND SOUND

No.	Subject	Author	Journal	Year
1	The small motion at the nodes of a vibrating string	C V Raman	<i>Nature</i>	1909
2	The maintenance of forced oscillations of a new type	C V Raman	<i>Nature</i>	1909
3	Maintenance of forced oscillations	C V. Raman	<i>Nature</i>	1910
4	Photographs of vibration curves	C V. Raman	<i>Phil Mag</i>	1911
5	Remarks on a paper by J S Stokes on some curious phenomena, observed in connection with Melde's experiment	C. V Raman	<i>Phy Rev.</i>	1911
6	The small motion at the nodes of a vibrating string	C V Raman	<i>Phy Rev.</i>	1911
7	On the maintenance of forced oscillation of a new type	C V Raman	<i>Phil Mag</i>	1912
8	Some remarkable cases of resonance	C V Raman	<i>Phy Rev</i>	1912
9	Experimental investigations on the maintenance of vibrations.	C V Raman	<i>Bull 6, Ind. Assoc. Cult. Sci.</i>	1912

10	The maintenance of vibrations .	C V. Raman		<i>Phys. Rev.</i>	1914
11	On motion in a periodic field of force	C V Raman		<i>Bull. 11, Ind. Assoc Cult Sci</i>	1914
12	On motion in a periodic field of force	C V Raman		<i>Phil Mag</i>	1915
13	On the maintenance of combination vibrations by two simple harmonic forces.	C V. Raman		<i>Phys Rev</i>	1915
14	On discontinuous wave-motion	C V. Raman and S Appa- swamyar.		<i>Phil Mag.</i>	1916
15	On discontinuous wave-motion, Part II	C. V Raman and A. Dey		<i>Phil. Mag</i>	1917
16	On discontinuous wave-motion, Part III	C V Raman and A Dey .		<i>Phil Mag.</i>	1917
17	The maintenance of vibrations by a periodic field of force	C V Raman and A. Dey .		<i>Phil Mag</i>	1917
18	Aerial waves generated by impact.	S K. Banerji		<i>Phil Mag.</i>	1917
19	On aerial waves generated by impact, Part II	S K. Banerji		<i>Phil Mag</i>	1918
20	An experimental method for the production of vibrations	C. V. Raman		<i>Phys. Rev.</i>	1919



No	Subject	Author	Journal	Year
21	A new method for the absolute determination of frequency.	A. Dey	<i>Proc. Roy. Soc.</i>	1919
22	Note on the theory of synchronous maintenance	C V. Raman	<i>Proc. Roy. Soc.</i>	1919
23	On the sounds of splashes	C V Raman and A Dey	<i>Phil. Mag.</i>	1920
24	On the forced oscillations of stretched strings under damping proportional to the square of the velocity	R N Ghosh	<i>Proc. Ind. Assoc. Cult. Sci.</i>	1920
25	Mechanical illustration of the theory of large oscillations and combination tones	B Banerji	<i>Proc. Ind. Assoc. Cult. Sci.</i>	1920
26	On the beating tones of singing flames	D D Banerji	<i>Proc. Ind. Assoc. Cult. Sci.</i>	1921
27	On the production of musical sounds from heated metals.	B N Chuckerbutti	<i>Proc. Ind. Assoc. Cult. Sci.</i>	1921
28	The whispering gallery phenomenon at St Paul's Cathedral	C V Raman and G. A. Sutherland	<i>Nature</i>	1921

29	On the whispering gallery phenomenon.	C V. Raman and G. A. Sutherland	..	<i>Proc. Roy Soc.</i>	..	1921
30	On whispering galleries	C. V. Raman	..	<i>Proc Ind. Assoc. Cult. Sci</i>	..	1922
31	On the theory and some applications of sub-synchronous pendulums	D D Banerji	..	<i>Proc Ind Assoc. Cult Sci.</i>	..	1922

## 2. THEORY OF MUSICAL INSTRUMENTS

No	Subject	Author	Journal	Year
1	Dynamical theory of the motion of bowed strings	C. V. Raman	<i>Bull 11, Ind. Assoc. Cult. Sci.</i>	1911
2	On the Wolf note of the violin and cello	C. V. Raman	<i>Nature</i>	1910
3	On the Wolf note in bowed stringed instruments	C. V. Raman	<i>Phil Mag</i>	1910
4	On the alterations of tone produced by a violin Mute	C. V. Raman	<i>Nature</i>	1917
5	On the Wolf note in bowed stringed instruments.	C. V. Raman	<i>Phil. Mag.</i>	1918
6	Wolf note in Pizzicato playing	C. V. Raman	<i>Nature</i>	1918
7	On the mechanical theory of the vibrations of bowed strings and of musical instruments of the violin family with experimental verification of the results. Part I.	C. V. Raman	<i>Bull 15, Ind Assoc. Cult Sci.</i>	1918
8	On the partial tones of bowed stringed instruments.	C. V. Raman	<i>Phil Mag.</i>	1910

9	On Kaufmann's theory of the impact of the pianoforte hammer	C V Raman and B. Banerji	<i>Proc. Roy. Soc.</i>	1919
10	On the mechanical violin-player for acoustical experiments	C V. Raman	<i>Phil. Mag</i>	1920
11	Musical drums with harmonic overtones.	C V Raman and S. Kumar	<i>Nature</i>	1920
12	Experiments with mechanically played violns	C V Raman	<i>Proc Ind Assoc Cult Sci</i>	1920
13	On some Indian stringed instruments.	C V Raman	<i>Proc. Ind Assoc Cult. Sci</i>	1921
14	Nature of vowel sounds	C. V Raman	<i>Nature</i>	1921
15	Vibration of the pianoforte string	P Das	<i>Proc Ind Assoc Cult Sci.</i>	1921
16	The acoustical knowledge of the ancient Hindus	C. V Raman	<i>Ind Mook. Sil Jub. Vol</i>	1922
17	On the beating tones of over-blown organ pipes	V Lough	<i>Phil Mag.</i>	1922
18	Investigations on the acoustics of the pianoforte	S K Datta	<i>Proc Ind Assoc. Cult Sci.</i>	1923
19	The subjective analysis of musical tones	C V Raman	<i>Nature</i>	1926

# THEORY OF MUSICAL INSTRUMENTS—Contd

No.	Subject	Author	Journal	Year
20	On the impact of an elastic hammer on a pianoforte string	P Das	<i>Ind. Jr. Phy</i>	1920
21	On the pressure exerted by an elastic hammer impinging on a pianoforte string	P Das	<i>Proc Ind Assoc Cult. Sci</i>	1920
22	A study of the acoustics of the stretched violin	R. N. Ghosh	<i>Ind Jr Phy.</i>	1920
23	The energy of a struck string	P. Das	<i>Ind Jr. Phy</i>	1927
24	The generalised law of vibration of bowed strings	M N. Mitra	<i>Ind Jr Phy.</i>	1927
25	Theory of the elastic pianoforte hammer	P. Das	<i>Proc. Roy. Soc.</i>	1927
26	Musical-instruments and the Kirtango	C. V. Raman	<i>Handbuch der Physik, VIII</i>	1927
27	On the acoustics of strings struck by a hard hammer.	P. Das and S K. Datta	<i>Phil. Mag</i>	1928
28	The vibration of the pianoforte sound-board.	L. D. Mahajan	<i>Ind. Jr Phy</i>	1930

29	Theory of the clarinet	P Das		<i>Ind. Jr. Phy</i>	1931
30	The vibration of the different parts of the pianoforte sound-board	L D Mahajan		<i>Ind Jr Phy</i>	1933
31	On the validity of the Raman-Banerji analysis of the pianoforte-hammer problem	K Venkatachala Iyengar		<i>Proc Ind. Acad Sci</i>	1931
32	Indian musical drums	C V. Raman		<i>Proc Ind Acad Sci.</i>	1931
33	The vibrating string considered as an electrical transmission line	W E Koch		<i>Jour Acous Soc Am.</i>	1937
34	Theory of Indian musical drums	K. Nagabhashana Rao		<i>Proc Ind Acad Sci</i>	1938

## 3. WAVE-OPTICS

No.	Subject	Author	Journal	Year
1	Unsymmetrical diffraction bands due to rectangular aperture	C V. Raman	<i>Phil Mag</i>	1906
2	Newton's rings in polarised light	C V. Raman	<i>Nature</i>	1907
3	Secondary waves of light	C V Raman	<i>Nature</i>	1908
4	The photometric measurement of the obliquity factor of diffraction	C V Raman	<i>Nature</i>	1909
5	The experimental study of Huygen's secondary waves	C V Raman	<i>Phil Mag</i>	1909
6	Photometric measurement of the obliquity factor of diffraction	C V Raman	<i>Phil Mag</i>	1911
7	On intermittent vision	C V Raman	<i>Phil. Mag</i>	1915
8	The colours of the striae in mica	C V Raman and P N. Ghosh.	<i>Nature</i>	1918
9	On some phenomena observed in the Foucault's test	S K. Banerji	<i>Astro Phys J.</i>	1918
10	Diffraction of light by cylinders of large radius	N. M. Basu	<i>Phil Mag</i>	1918

11	On Haidinger's rings in mica .	T. K. Chinnmayanandam	<i>Proc Roy Soc.</i>	1918
12	On the asymmetry of illumination curves in oblique diffraction	S. K. Mitra	<i>Phil Mag.</i>	1918
13	Diffraction of light by an obliquely held cylinder.	T. K. Chinnmayanandam	<i>Phy Rev</i>	1918
14	On the radiation of light from the boundaries of diffracting apertures	S. K. Banerji	<i>Phil Mag.</i>	1919
15	On the flow of energy in the electro-magnetic field surrounding a perfectly reflecting cylinder.	T. K. Chinnmayanandam	<i>Phil Mag</i>	1919
16	On the large-angle diffraction by apertures with curvilinear boundaries	S. K. Mitra	<i>Phil Mag.</i>	1919
17	On the Sommerfeld's treatment of the problem of diffraction by a semi-infinite screen	S. K. Mitra	<i>Phil Mag</i>	1919
18	On the theory of superposed diffraction fringes	C. Prasad	<i>Phy Rev.</i>	1919
19	On the diffraction figures due to an elliptic aperture.	C. V. Raman	<i>Phy Rev</i>	1919



## WAVE-OPTICS—Contd

No	Subject	Author	Journal	Year
20	On the diffraction theory of microscope vision	P N Ghosh	<i>Phys. Rev.</i>	1910
21	On the colours of the stars in mica and the radiation from laminar diffracting boundaries	P. N. Ghosh	<i>Proc. Roy. Soc.</i>	1910
22	On the theory of Powoll's bands and the group-velocity in dispersive media	N K Sethi	<i>Phy Rev</i>	1920
23	On a new geometrical theory of the diffraction figures observed on the heliometer	S K Mitra	<i>Proc Ind Assoc. Cult Sci</i>	1920
24	Some phenomena of laminar diffraction observed with mica	P. N. Ghosh	<i>Proc Ind Assoc Cult Sci</i>	1921
25	On Quetelet's rings and other allied phenomena	C V. Raman and G. L. Datta.	<i>Phil Mag</i>	1921
26	Diffraction of light by cylinders and spheres immersed in a medium of nearly equal refractive index	N K Sethi	<i>Phil Mag</i>	1921
27	Colours of mixed plates, Part I.	C. V. Raman and B. Banerji	<i>Phil Mag.</i>	1921

28	Colours of mixed plates, Part II.	C. V Raman and B Banerji	<i>Phil Mag</i>	1921
29	On the flow of energy near an optical focus	T. K Chinmayanandam	<i>Proc Ind Assoc Cult Sci</i>	1921
30	On the colours of mixed plates Part III.	C V Raman and K. Seshagiri Rao	<i>Phil Mag</i>	1921
31	The colours of breathed-on plates	C V Raman	<i>Nature</i>	1921
32	A method of improving visibility of distant objects	C. V Raman	<i>Nature</i>	1921
33	On the diffraction of light incident at nearly the critical angle on the boundary between two media	B N Chuckerbutti	<i>Proc Roy Soc</i>	1921
34	On Talbot's bands and the colour sequence of the spectrum	N K Sethi	<i>Phil Mag.</i>	1921
35	On Talbot's bands and the theory of the Lummer-Gehrcke interferometer	N. K Sethi	<i>Phys. Rev.</i>	1921
36	Some observations on interference phenomena in non-homogeneous light.	N. K Sethi	<i>Proc. Ind. Assoc Cult Sci</i>	1921
37	Some new illustrations of optical theory by ripple motion	R N. Ghosh	<i>Proc Ind. Assoc Cult. Sci.</i>	1921

## WAVE-OPTICS—Contd.

No	Subject	Author	Journal	Year
38	Optical analogue of the whispering gallery effect.	B. B. Ray	<i>Cal. Math. Soc. Bull.</i>	1922
39	Einstein's aberration experiment	C. V. Raman	<i>Nature</i>	1922
40	Einstein's aberration experiment	C. V. Raman	<i>Astro. Phys. J.</i>	1922
41	On diffraction of light by aperture having the form of a segment of a circle.	S. K. Mitra	<i>Indian Mathematical Society Jubilee Volume</i>	1922
42	On the convection of light in moving media	C. V. Raman and N. K. Sethi	<i>Phil. Mag.</i>	1922
43	Quartz's rings in mica	N. K. Sethi and C. M. Sengupta	<i>Proc. Ind. Assoc. Cult. Sci.</i>	1922
44	Columns of tempered steel	C. V. Raman	<i>Nature</i>	1922
45	On the columns of tempered steel and other tarnished metal surfaces.	B. N. Chakraborty	<i>Proc. Ind. Assoc. Cult. Sci.</i>	1922
46	On laminar diffraction and the theory of micro-copic vision.	N. K. Sur	<i>Proc. Ind. Assoc. Cult. Sci.</i>	1922

47	On the diffraction of light by a reflecting cone	A B Datta	<i>Cal. Math Soc Bull.</i>	1922
48	Formation of optical images by diffracting boundaries	A. B Datta	<i>Cal Math Soc Bull</i>	1922
49	Caustics formed by diffraction	P Das	<i>Cal Math Soc Bull</i>	1922
50	Note on a departure from Fresnel's laws of reflection	N K Sur	<i>Phy Rev</i>	1923
51	On the colours of mixed plates, Part IV	K Seshagiri Rao	<i>Proc Ind Assoc Cult Sci</i>	1923
52	Effect of a retarding plate on white-light interferometer fringes	N. K Sethi	<i>Phy. Rev</i>	1924
53	The nature of the disturbance in the second medium in total reflection	C V Raman	<i>Phil Mag</i>	1925
54	On Brewster's bands, Part I	C V Raman and S K Datta	<i>Trans Opt Soc. Am</i>	1925
55	On the colours shown by Nobeli's rings	B N Chuckerbutta	<i>Proc Ind. Assoc Cult Sci.</i>	1925
56	On the diffraction of light by spherical obstacles	C V Raman and K S Krishnan	<i>Proc Phy Soc.</i>	1926
57	The optical study of percussion figures	C V Raman	<i>Jr Opt Soc Am</i>	1926

## WAVE-OPTICS—Contd

No	Subject	Author	Journal	Year
58	On the total reflection of light ..	C. V Raman	<i>Proc Ind Assor. Cult. Sci.</i>	1920
59	Rayen's principle and the phenomenon of total reflection	C V Raman	<i>Trans. Opt. Soc. London</i>	1920
60	The diffraction of light by metallic screens,	C V Raman and K S Kilishnan,	<i>Proc. Roy. Soc.</i>	1927
61	Thickness of the optical transition layer in liquid surfaces,	C V Raman and L A Ramdas	<i>Phil. Mag.</i>	1927
62	Diffraction of light by a transparent lamina.	C V. Raman and I. Ramakrishna Rao	<i>Proc Phys. Soc.</i>	1927
63	On Brewster's bands, Part II	S K. Datta	<i>Trans Opt Soc. London</i>	1927
64	Studies in laminar diffraction, Part I. Colours of mixed plates	I. Ramakrishna Rao	<i>Ind Jr Phy</i>	1928
65	Studies in laminar diffraction, Part II Laminar boundaries in mica	I Ramakrishna Rao	<i>Ind. Jr Phy.</i>	1928
66	Laminar diffraction and the Beeko phenomenon.	P. Rama Plshavoty	<i>Proc Ind. Acad. Sci.</i>	1935

# 4. COLLOID STUDIES

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No	Subject	Author	Journal	Year
1	Historic note on the discovery of the ultra-microscopic method	C V. Raman	<i>Phil. Mag.</i>	1909
2	The scattering of light in the refractive media of the eye.	C V Raman	<i>Phil. Mag.</i>	1919
3	The phenomenon of the radiant spectrum observed by Sir David Brewster.	C V Raman	<i>Nature</i>	1921
4	On wave propagation in optically heterogeneous media and the phenomena observed in Christensen's experiment	N. K. Sethi	<i>Proc Ind. Assoc Cult. Sci.</i>	1921
5	On the transmission colours of sulphur suspensions.	C V Raman and B B Ray	<i>Proc. Roy. Soc.</i>	1921
6	Scattering of light by sulphur suspensions	B B. Ray	<i>Proc. Ind Assoc Cult Sci.</i>	1921
7	The scattering of light by liquid droplets and the theory of coronas, glories and iridescent clouds	B B. Ray	<i>Proc Ind Assoc. Cult Sci.</i>	1922

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No.	Subject	Author	Journal	Year
8	On the phenomenon of radiant spectrum,	C. V. Raman	Phil. Mag.	1922
9	The radiant spectrum,	C. V. Raman	Nature	1922
10	The volume of colloids in relation to the size of the dispersed particles,	R. B. Ray	Proc. Ind. Assoc. Cult. Sci.	1923
11	Scattering of light by amethyst, quartz,	N. K. Sirc	Proc. Ind. Assoc. Cult. Sci.	1923
12	Scattering of light by powdered metallic surfaces,	L. A. Raman	Proc. Ind. Assoc. Cult. Sci.	1925
13	The scattering of light by solid surfaces,	L. A. Raman	Proc. Ind. Assoc. Cult. Sci.	1925
14	Die Zerstreuung des Lichtes durch dielektrische Körper,	C. V. Raman	Zett. f. Phys.	1925
15	On the optical properties of chromatic emulsions,	C. M. Sogaul	Phil. Mag.	1926
16	Optical behaviour of protein solutions,	C. V. Raman	Nature	1927

17	Relation of Tyndall effect to osmotic pressure in colloidal solutions	C. V. Raman	..	<i>Ind Jr Phys.</i>	..	1927
18	Photographs of coronas in monochromatic light	M Mitra	.	<i>Ind Jr Phys</i>		1928
19	Transmission of light through suspensions of powdered crystals	B. Mukhopadhyaya	.	<i>Ind Jr Phys.</i>		1932
20	The scattering of light by particles suspended in a medium of higher refractive index	R S Krishnan		<i>Proc Ind. Acad Sci</i>		1934
21	On the depolarisation of Tyndall scattering in colloids	D. S Subbaramayya	.	<i>Proc Ind Acad Sci.</i>		1935
22	On the depolarisation of Tyndall scattering in colloids	R S Krishnan		<i>Proc. Ind Acad Sci</i>		1935
23	The reciprocity theorem in colloid optics.	R S Krishnan	..	<i>Proc Ind Acad Sci.</i>		1935
24	Light-scattering in gold sols in relation to particle size and shape	D. S Subbaramayya	..	<i>Proc Ind. Acad Sci.</i>		1935
25	Dispersion of depolarisation of light-scattering in colloids, Part I — Gold sols.	R S Krishnan	..	<i>Proc. Ind Acad. Sci.</i>		1937



No	Subject	Author	Journal	Year
26	Studies in colloid optics, Part I Scattering of light by protein solutions	K Subbaramiah	<i>Proc Ind Acad Sci</i>	1937
27	Studies in colloid optics, Part II Scattering of light in silicic acid sols and gels	K Subbaramiah	<i>Proc Ind Acad Sci</i>	1937
28	Dispersion of depolarisation of light-scattering in colloids, Part II —Silver sols	R S Krishnan	<i>Proc Ind Acad Sci</i>	1937
29	Dispersion of depolarisation of light-scattering in colloids, Part III —Platinum, copper, sele- num and tellurium sols	R S Krishnan	<i>Proc Ind Acad Sci</i>	1937
30	Dispersion of depolarisation of light-scattering in colloids, Part IV —Iodine, graphite, stearic acid, vanadium pento- xide, arsenic trisulphide and ferric hydroxide sols	R S Krishnan	<i>Proc Ind Acad Sci</i>	1937
31	Dispersion of depolarisation of light-scattering in colloids, Part V —Colloidal dye stuffs	R S Krishnan	<i>Proc Ind Acad Sci</i>	1937

32	Reciprocity theorem in colloid optics	R S Krishnan	.	<i>Curr. Sci.</i>	1937
33	Reciprocity theorem in colloid optics and its generalisation.	R S Krishnan	.	<i>Proc Ind Acad. Sci</i>	1938
34	Studies on light-scattering in emulsions, Part I — Dilute simple emulsions	R S. Krishnan	.	<i>Proc Ind Acad Sci</i>	1938
35	Reciprocity theorem in colloid optics, case of orientated particles.	R. S Krishnan	.	<i>Proc Ind Acad Sci</i>	1938

# 5. MOLECULAR SCATTERING OF LIGHT

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No	Subject	Author	Journal	Year
1	The Doppler effect in the molecular scattering of radiation	C. V. Raman	<i>Nature</i>	1910
2	The colour of the sea	C V Raman	<i>Nature</i>	1921
3	The molecular scattering of light in liquids and solids.	C V. Raman	<i>Nature</i>	1921
4	Molecular rototropy in liquids	C V. Raman	<i>Nature</i>	1922
5	Molecular diffraction of light	C V Raman	Cal University Press	1922
6	Opalescence phenomena in liquid mixtures.	O. V Raman	<i>Nature</i>	1922
7	Transparency of liquids and the colour of the sea	C V. Raman	<i>Nature</i>	1922
8	Anisotropy of molecules	C V. Raman	<i>Nature</i>	1922
9	Optical observation of the thermal agitation of the atoms in crystals	C V. Raman	<i>Nature</i>	1922
10	Molecular structure of amorphous solids	C. V. Raman	<i>Nature</i>	1922

11	Diffraction by molecular clusters and the quantum structure of light	C V Raman	<i>Nature</i>	1922
12	On the molecular scattering of light in water and the colour of the sea	C V Raman	<i>Proc Roy. Soc</i>	1922
13	On the molecular scattering of light in vapours and in liquids and its relation to the opalescence observed in the critical state	K. R Ramanathan	<i>Proc Roy Soc</i>	1922
14	Electro-magnetic theory of the scattering of light in fluids	K. R Ramanathan	<i>Proc. Ind. Assoc Cult Sci</i>	1922
15	On the molecular scattering of light in dense vapours and gases	C V Raman and K R Ramanathan	<i>Phil Mag</i>	1923
16	On the molecular scattering of light in liquid mixtures	C V Raman and K R Ramanathan	<i>Phil Mag</i>	1923
17	Molecular scattering of light in carbon-dioxide at high pressures	C V Raman and K. R Ramanathan	<i>Proc Roy Soc</i>	1923
18	On the molecular scattering and extinction of light in liquids and the determination of the Avogadro constant	C V Raman and K Seshagiri Rao	<i>Phil Mag</i>	1923
19	On the colour of the sea.	K R Ramanathan	<i>Phil Mag</i>	1923

# MOLECULAR SCATTERING OF LIGHT—Contd

No	Subject	Author	Journal	Year
20	On the visual and photographic albedo of the earth	K R Ramanathan	<i>Astro. Phys. Jr</i>	1923
21	A study of the critical opalescence of carbon dioxide	D. K Bhattacharyya	<i>Proc. Ind. Assoc. Cult. Sci</i>	1923
22	The scattering of light by anisotropic molecules	C V Raman	<i>Nature</i>	1923
23	Thermal opalescence in crystals and the colour of ice in glaciers	C V Raman	<i>Nature</i>	1923
24	On the polarisation of the light scattered by gases and vapours	C V Raman and K Seshagiri Rao	<i>Phil. Mag.</i>	1923
25	Electro-magnetic theory of the scattering of light in fluids, Part B	K R Ramanathan	<i>Proc. Ind. Assoc. Cult. Sci</i>	1923
26	The scattering of light by liquid and solid surfaces	C V Raman	<i>Nature</i>	1923
27	Molecular scattering of light in benzene vapour and liquid	K R. Ramanathan	<i>Phy. Rev</i>	1923
28	Molecular scattering of light in liquid mixtures	J O Kameswara Rao	<i>Phy. Rev</i>	1923

29	Oblique scattering of light in gases and liquids	A S Ganesan	<i>Phy. Rev.</i>	1924
30	The structure of molecules in relation to their optical anisotropy	C V Raman	<i>Nature</i>	1924
31	The structure of benzene and cyclohexane and their optical anisotropy	K R Ramanathan	<i>Nature</i>	1925
32	Transparency and colour of the sea	K R. Ramanathan	<i>Phy. Rev.</i>	1925
33	On the polarisation of light scattered by organic vapours	A S Ganesan	<i>Phil. Mag.</i>	1925
34	On the molecular scattering of light in liquids	K. S. Krishnan	<i>Phil. Mag.</i>	1952
35	The structure of molecules in relation to their optical anisotropy	K R Ramanathan	<i>Proc Roy Soc</i>	1925
36	The structure of molecules in relation to their optical anisotropy, Part II.—Benzene and cyclohexane	K R. Ramanathan	<i>Proc Roy Soc</i>	1926
37	On the scattering of light in mixtures of air and carbon dioxide	D D Banerji	<i>Phy Rev</i>	1925

# MOLECULAR SCATTERING OF LIGHT—Contd.

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No	Subject	Author	Journal	Year
98	Optical constants of binary liquid mixtures	J C Kamewara Rao	<i>Proc Ind Assoc Cult Sci.</i>	1925
99	The molecular scattering of light at the critical state	M N Mitra	<i>Ind Jr Phy</i>	1926
100	Scattering of light by gaseous mixtures at high pressures	L A Ramdani	<i>Phy Rev</i>	1926
101	A discussion of the available data on light scattering in fluids	K S Krishnan	<i>Proc Ind Assoc Cult Sci</i>	1926
102	The scattering of light in amorphous solids	C V Raman	<i>Trans Opt Soc Am.</i>	1927
103	The molecular scattering of light in binary liquid mixtures	C V Raman	<i>Phil. Mag</i>	1927
104	On fluctuations of dielectric constants in liquids and theories of molecular scattering of light	K R Ramanathan	<i>Ind Jr Phy</i>	1927
105	Scattering of light by liquids at high temperatures	S. Ramachandra Rao	<i>Ind Jr. Phy</i>	1927

46	Determination and discussion of light-scattering data for 10 gases and 63 vapours of organic compounds	I Ramakrishna Rao	<i>Ind Jr. Phy.</i>	1927
47	The molecular scattering of light in aqueous solutions, Part I	S Venkateswaran	<i>Ind Jr Phy</i>	1927
48	The molecular scattering of light in aqueous solutions, Part II	S Venkateswaran	<i>Ind J, Phy.</i>	1927
49	Scattering of light by aromatic compounds	A N Banerji	<i>Ind Jr. Phy</i>	1927
50	Further studies in light-scattering in liquids at high temperatures	S Ramachandra Rao	<i>Ind Jr Phy.</i>	1927
51	The optical anisotropy of atoms and molecules	I Ramakrishna Rao	<i>Ind Jr Phy</i>	1928
52	A theory of light-scattering in liquids	C. V Raman and K S Krishnan.	<i>Phil Mag</i>	1928
53	Effect of molecular form and association on light-scattering in liquids, Part I.—Fatty acids and alcohols	S Ramachandra Rao	<i>Ind Jr Phy</i>	1928
54	Effect of molecular form and association on light-scattering in liquids, Part II —Some aromatics	S. Ramachandra Rao	<i>Ind Jr Phy.</i>	1928



No	Subject	Author	Journal	Year
55	Investigations of scattering of light	C. V Raman	<i>Nature</i>	1929
56	The theory of light scattering in liquids	C. V Raman	<i>Phil Mag</i>	1929
57	Colour and optical anisotropy of organic compounds	C V Raman	<i>Nature</i>	1929
58	Doppler effect in light-scattering	C V Raman	<i>Nature</i>	1931
59	A note on the scattering of light in urmes	S Ranganathan	<i>Ind Jr Phy</i>	1931
60	Light-scattering in liquids	S Venkateswaran	<i>Nature</i>	1931
61	Polarisation of light-scattering	S Venkateswaran	<i>Phil. Mag</i>	1932
62	Light scattering in relation to molecular structure. New data for depolarisation in 39 gases	S Parthasarathy	<i>Ind Jr Phy</i>	1932
63	Are argon and methane molecules optically anisotropic?	S Parthasarathy	<i>Ind. Jr Phy</i>	1932
64	The spinning photon and its scattering by molecules	S Bhagavantam	<i>Nature</i>	1932

65	Studies in light-scattering by binary liquid mixtures	S. Parthasarathy	<i>Ind Jr Phy</i>	1933
66	The scattering of light by binary gaseous mixtures	R. Ananthakrishnan	<i>Ind Jr Phy</i>	1934
67	On the Plotnikow effect or longitudinal light-scattering in liquids	R. S. Krishnan	<i>Proc. Ind Acad Sci</i>	1934
68	Photo-electric photometry of light-scattering in fluids	R. Ananthakrishnan	<i>Proc. Ind Acad Sci</i>	1934
69	Optical evidence for molecular clustering in fluids.	R. S. Krishnan	<i>Proc Ind Acad Sci</i>	1934
70	On the scattering of light by thin liquid surfaces	S. Jagannathan	<i>Proc Ind Acad Sci</i>	1934
71	The scattering of light by thin metallic films	S. Rama Swamy	<i>Proc Ind Acad Sci</i>	1935
72	Molecular clustering in binary liquid mixtures	R. S. Krishnan	<i>Proc. Ind Acad Sci</i>	1935
73	Molecular clustering in binary liquid mixtures. Variation with composition and temperature.	R. S. Krishnan	<i>Proc. Ind Acad Sci</i>	1935
74	On the convergence error in depolarisation measurements	R. Ananthakrishnan	<i>Proc Ind Acad. Sci</i>	1935

# MOLECULAR SCATTERING OF LIGHT -Contd

No.	Subject	Author	Journal	Year
75	Redetermination of the depolarisation of light-scattering in gases and vapours.	R. Ananthakrishnan	Proc Ind Acad Sci	1935
76	Scattering of light in optical glasses	R. S. Krishnan	Proc. Ind. Acad. Sci.	1936
77	Molecular clustering in liquid fatty acids	R. S. Krishnan	Proc. Ind. Acad. Sci.	1936
78	Dispersion of depolarisation of Rayleigh scattering, Part I — Fatty acids	R. S. Krishnan	Proc. Ind. Acad Sci.	1936
79	Critical opalescence of binary liquid mixtures.	R. S. Krishnan	Proc Ind. Acad. Sci.	1937

## 6. X-RAYS AND ELECTRON DIFFRACTION

No	Subject	Author	Journal	Year
1	Scattering of X-rays in liquids	C V. Raman	<i>Nature</i>	1923
2	Nature of liquid state	C V Raman	<i>Nature</i>	1923
3	Diffraction of X-rays in liquids, liquid mixtures, fluid crystals and amorphous solids	C V. Raman and K R Ramanathan	<i>Proc Ind Assoc Cult Sci</i>	1923
4	On the mean distance between neighbouring molecules in a fluid	C V Raman	<i>Phil Mag</i>	1924
5	Thermal degeneration of X-ray haloes in liquids	C V Raman	<i>Nature</i>	1927
6	X-ray diffraction in liquids	C V Raman and C M Sogani.	<i>Nature</i>	1927
7	X-ray diffraction in liquids	C. V Raman and C M Sogani	<i>Nature</i>	1927
8	X-ray diffraction in liquids	C M Sogani	<i>Ind J, Phy</i>	1927
9	Further studies in X-ray diffraction in liquids.	C M Sogani	<i>Ind Jr Phy</i>	1927

# X-RAYS AND ELECTRON DIFFRACTION—Contd

No	Subject	Author	Journal	Year
10	Thermodynamics, wave theory and the Compton effect.	G. V. Raman	<i>Nature</i>	1927
11	A critical absorption photometer for the study of the Compton effect	C. V. Raman and C. M. Soganl.	<i>Proc Roy. Soc</i>	1928
12	Crystal structure of paranitro-toluene	B. N. Sreenivasiah	<i>Ind Jr Phy</i>	1928
13	The relation between chemical constitution and X-ray diffraction in liquids, Part I	P. Krishnamurti	<i>Ind Jr. Phy.</i>	1928
14	X-ray diffraction in carbon tetrachloride (liquid).	C. M. Soganl	<i>Ind Jr Phy</i>	1928
15	X-ray diffraction and its bearing on the molecular complexity in the liquid state	P. Krishnamurti	<i>Ind Jr. Phy.</i>	1928
16	X-ray diffraction in aqueous solutions and liquid mixtures, Part I	P. Krishnamurti	<i>Ind Jr. Phy.</i>	1928

17	Thermal degeneration of the X-ray haloes in liquids and amorphous solids	S S. Ramasubramanyan	<i>Ind. Jr. Phy.</i>	..	1928
18	The diffraction of X-rays by aqueous solutions of cane sugar, levulose and glucose	P Krishnamurti	<i>Ind. Jr. Phy</i>	..	1928
19	X-ray diffraction of crystal powders and liquids in relation to their constitution	P Krishnamurti	<i>Ind. Jr. Phy</i>	..	1928
20	The Raman effect in X-ray scattering	K. S Krishnan	<i>Nature</i>	..	1928
21	X-ray diffraction in liquid mixtures	P. Krishnamurti	<i>Ind. Jr. Phy</i>	..	1928
22	On the nature of dextrin, gelatin and sodium oleate solutions as revealed by X-ray diffraction	P Krishnamurti	<i>Ind Jr. Phy</i>	..	1929
23	A classical derivation of the Compton effect	C. V. Raman	<i>Ind Jr Phy</i>	..	1928
24	A new X-ray effect	C V Raman and P Krishnamurti	<i>Nature</i>	..	1929
25	X-ray diffraction in liquid alloys of sodium and potassium.	K Banerji	<i>Ind Jr Phy</i>	..	1929

No.	Subject	Author	Journal	Year
26	X-ray diffraction in liquids and solutions and the molecular structure factor.	P. Krishnamurti	<i>Ind. Jr. Phys.</i>	1920
27	X-ray diffraction of liquids in the terpene series.	V. I. Vaidyanathan	<i>Ind. Jr. Phys.</i>	1920
28	Influence of temperature on the X-ray liquid haloes	V. I. Vaidyanathan	<i>Ind. Jr. Phys.</i>	1920
29	X-ray study of vitreous and duran and their constituents	O. Mahadovan	<i>Ind. Jr. Phys.</i>	1920
30	Structure of some organic crystals.	S. Bhargavan	<i>Proc. Ind. Chem (India).</i>	1920
31	X-ray diffraction by amorphous solids.	P. Krishnamurti	<i>Ind. Jr. Phys.</i>	1920
32	X-ray diffraction in liquid hexamethyl benzene.	P. Krishnamurti	<i>Ind. Jr. Phys.</i>	1930
33	Further X-ray studies of carbonaceous and bituminous materials.	O. Mahadovan	<i>Ind. Jr. Phys.</i>	1930

34	On the Laue photographs of iridescent crystals of potassium chlorate	S. C. Sirlkar	..	<i>Ind Jr Phy.</i>	.	1930
35	X-ray diffraction in heated liquids and solutions	V I Vaidyanathan	.	<i>Ind Jr Phy.</i>	.	1930
36	X-ray studies of natural and fossil resins	C. Mahadevan	.	<i>Ind Jr. Phy.</i>	..	1930
37	Studies in X-ray diffraction, Part I.—Structure of amor- phous carbon	P. Krishnamurti	.	<i>Ind. Jr. Phy.</i>	.	1930
38	Studies in X-ray diffraction, Part II —Some colloidal solu- tions and liquid mixtures.	P. Krishnamurti	..	<i>Ind Jr Phy.</i>	.	1930
39	X-ray study of vitreous	C Mahadevan	.	<i>Ind Jr. Phy</i>	.	1930
40	Studies in X-ray diffraction, Part III —Some aromatic hydrocarbons in solid and liquid states	P. Krishnamurti	..	<i>Ind Jr Phy.</i>	.	1930
41	Liquid structure and X-ray dif- fraction in liquids	K Banerji	.	<i>Ind Jr Phy.</i>	.	1930
42	X-ray diffraction studies in cal- culi	S Ranganathan	..	<i>Ind Jr. Phy.</i>	.	1931



# X-RAYS AND ELECTRON DIFFRACTION—Contd.

No.	Subject	Author	Journal	Year
13	X-ray analysis of the structure of diphenyl	J. Dhar	<i>Ind. Jr. Phys.</i>	1932
41	X-ray diffraction in liquid mixtures.	S. Parthasarathy	<i>Phil. Mag.</i>	1931
15	X-ray analysis of the structure of fluorescent shells, Part I	S. Rama Swamy	<i>Proc Ind. Acad. Sci.</i>	1935
10	X-ray analysis of the structure of fluorescent shells, Part II — The halobates.	S. Rama Swamy	<i>Proc. Ind. Acad. Sci.</i>	1935
47	The structure of metallo films.	S. Rama Swamy	<i>Proc Ind. Acad Sci.</i>	1936
18	X ray diffraction and electrolytic dissociation, Part I.—Sulphuric acid and sulphates.	R. S. Krishnan	<i>Proc Ind Acad. Sci.</i>	1936
10	X-ray studies of wood, lignin and wood cellulose.	P. Nallakantan	<i>Proc. Ind. Acad. Sci</i>	1937
50	X-ray analysis of the structure of a fibrous modification of tannin.	S. Rama Swamy and K. Y. S. Iyengar.	<i>Proc. Ind. Acad. Sci.</i>	1937

# 7. MAGNETISM AND MAGNETO-OPTICS

No	Subject	Author	Journal	Year
1	The magneto-crystalline properties of the Indian Braunites	K Seshagiri Rao	<i>Proc Ind. Assoc Cult Sci</i>	1920
2	Are gaseous molecules oriented in a magnetic field?	K S Krishnan	<i>Ind Jr. Phy</i>	1926
3	On the magnetic susceptibilities of gases at low pressures	V. I Vaidyanathan	<i>Ind. Jr. Phy.</i>	1926
4	Magnetic double refraction	C V Raman and I Raman Krishna Rao	<i>Nature</i>	1927
5	Magnetic double refraction in liquids, Part I—Benzene and its derivatives.	C V Raman and K S Krishnan	<i>Proc Roy Soc.</i>	1927
6	A theory of electric and magnetic birefringence in liquids	C V Raman and K S Krishnan	<i>Proc. Roy Soc</i>	1927
7	The magnetic anisotropy of crystalline nitrates and carbonates	K S Krishnan and C V Raman	<i>Proc Roy. Soc</i>	1927
8	Magnetic double refraction in paramagnetic gases	K S Krishnan	<i>Ind Jr Phy</i>	1927

# MAGNETISM AND MAGNETO-OPTICS---Contd.

No.	Subject	Author	Journal	Year
9	La constant de birefringence magnetique du benzene.	O V Raman and K S Krishnan.	Compt Rend.	1927
10	On the magnetic susceptibilities of vapours of organic liquids	V. I. Vaidyanathan	Phys. Rev	1927
11	On the magnetic susceptibilities of ozonides.	V. I. Vaidyanathan	Ind. Jr. Phy	1928
12	On the magnetic susceptibility of ozone	V I Vaidyanathan	Ind. Jr. Phy	1928
13	On the relation of diamagnetic susceptibility in the liquid and vapour states.	V. I. Vaidyanathan	Ind. Jr Phy.	1928
14	On diamagnetism and structure of ethylene	V. I. Vaidyanathan	Ind. Jr Phy	1928
15	On the diamagnetic susceptibility of gases at low pressures.	V. I. Vaidyanathan	Phil Mag.	1928
16	Diamagnetism and crystal structure	C. V. Raman	Nature	1929
17	Magnetic behaviour of organic crystals.	O V Raman	Nature	1929

18	Anomalous diamagnetism	C V Raman	.	<i>Nature</i>	1929
19	Magnetic birefringence in solutions and its relation to crystal structure and properties	M. Ramanadham	.	<i>Ind. Jr. Phy</i>	1929
20	The magnetic anisotropy of naphthalene crystals	S Bhagavantam	.	<i>Proc. Roy Soc</i>	1929
21	Magnetic and optical properties of benzene ring in aromatic compounds	S Bhagavantam	.	<i>Proc Roy Soc.</i>	1929
22	Anomalous diamagnetism of graphite	S. Paramasivan	.	<i>Ind. Jr. Phy.</i>	1929
23	Magnetic behaviour of some organic crystals	S Bhagavantam	.	<i>Ind Jr Phy</i>	1929
24	Magnetic birefringence in liquids of the aliphatic series	M Ramanadham	.	<i>Ind Jr Phy</i>	1929
25	Diamagnetism and molecular structure	C V Raman	.	<i>Proc Phys Soc London.</i>	1930
26	Anomalous diamagnetism and crystal structure	V I Vaidyanathan	.	<i>Ind Ir Phy</i>	1930
27	Orientation of the molecules in naphthalene and anthracene crystals	K Banerji	.	<i>Ind Jr Phy</i>	1930

No.	Subject	Author	Journal	Year
28	India's debt to Faraday	C V Raman	<i>Nature</i>	1931
29	Magnetic double refraction in aliphatic liquids	S W Chunchalkar	<i>Ind Jr Phy.</i>	1931
30	A new type of magnetic birefringence	O V Raman and S W Chunchalkar	<i>Nature</i>	1931
31	Magnetic susceptibilities of liquid mixtures	S P Raunganadham	<i>Ind Jr. Phy.</i>	1931
32	Magnetic birefringence and molecular anisotropy	S W Chunchalkar	<i>Ind Jr Phy</i>	1931
33	A new type of magnetic birefringence	S W Chunchalkar	<i>Ind Jr Phy</i>	1931
34	Thermal variation and Faraday rotation	P K Pillai	<i>Ind J, Phy</i>	1931
35	Diamagnetism of liquid mixtures.	S P. Raunganadham	<i>Nature</i>	1931
36	Magnetic birefringence in solutions of sodium chlorate and sodium bromate.	S W. Chunchalkar	<i>Ind. J, Phy.</i>	1932

37	A note on the variation of Faraday effect with concentration	P. K. Pillai	<i>Ind Jr Phy.</i>	1932
38	Magnetic birefringence in liquid mixtures	S W Chunchalkar	<i>Ind Jr Phy.</i>	1933
39	The magnetic anisotropy of naturally occurring substances, Part I —Mother-of-pearl.	P. Nilakantan	<i>Proc Ind Acad Sci</i>	1935
40	Magnetic anisotropy of naturally occurring substances, Part II —Molluscan shells	P Nilakantan	<i>Proc Ind Acad Sci</i>	1936
41	Magnetic anisotropy of rhombic sulphur	P Nilakantan	<i>Proc Ind Acad Sci</i>	1936
42	Temperature variation of the magnetic anisotropy of ammonium nitrate	P Nilakantan	<i>Phy Rev</i>	1937
43	Temperature variation of magnetic anisotropy of organic crystals	P Nilakantan	<i>Nature</i>	1937
44	Magnetic anisotropy of naturally occurring substances, Part III —Wood lignin, and wood cellulose	P Nilakantan	<i>Proc Ind Acad Sci</i>	1938

# S. ELECTRO-OPTICS AND DIELECTRIC BEHAVIOUR

No	Subject	Author	Journal	Year
1	Electrical polarity of molecules	C V Raman and K S Krishnan	<i>Nature</i>	1926
2	Electrical double refraction in relation to polarity and optical anisotropy of molecules, Part I Gases and vapours	C V Raman and K S Krishnan	<i>Phil Mag</i>	1927
3	Electrical double refraction in relation to polarity and optical anisotropy of molecules, Part II Liquids	C V Raman and K S Krishnan	<i>Phil Mag</i>	1927
4	A theory of the optical and electrical properties of liquids	C V Raman and K S Krishnan	<i>Proc Roy Soc.</i>	1928
5	Disappearance and reversal of the Kerr effect	C V Raman and S C Sirkar	<i>Nature</i>	1928
6	The electric moment of methyl chloride, ethyl chloride and chloroform	S C Sirkar	<i>Ind. Jr. Phy</i>	1928
7	The relation between colour and molecular structure in organic compounds	C V Raman and S Bhagavantam.	<i>Ind. Jr Phy.</i>	1929

8	Kerr effect in viscous liquids	S C Sirkar	<i>Ind. Jr Phy</i>	1929
9	Electric polarisability and diamagnetic susceptibility of molecules	S Bhagavantam	<i>Ind Jr Phy</i>	1932
10	The dipole moment of chloromethyl ether	M A Govinda Rau and B N N Swamy.	<i>Proc Ind Acad Sci</i>	1934
11	The refractivity of liquid mixtures	G Narasimhaaya	<i>Proc. Ind Acad Sci</i>	1934
12	Theory of solvent effect in dipole moment measurements	M A Govinda Rau	<i>Proc Ind Acad Sci.</i>	1934
13	Effect of solvent in dipole moment measurements, polarisation and the moment of nitrobenzene	M A Govinda Rau and B N N. Swamy	<i>Proc. Ind Acad Sci</i>	1934
14	The dielectric constants of liquids and liquid mixtures	D S Subbaramayya	<i>Proc Ind. Acad Sci</i>	1935
15	The effect of solvent in dipole moment measurements, the dipole moment of ethylene bromide	M A Govinda Rau and B N N Swamy	<i>Proc Ind Acad. Sci</i>	1935
16	On the dipole moment of tetralin	M A Govinda Rau and S Sathyanarayana Rao	<i>Proc Ind Acad. Sci</i>	1935



# ELECTRO-OPTICS AND DIELECTRIC BEHAVIOUR—Contd

No	Subject	Author	Journal	Year
17	Refractive indices and dispersions of volatile compounds of fluorine and boron	K. L. Ramaswamy	<i>Proc Ind Acad Sci</i>	1935
18	Dielectric coefficients of volatile compounds of fluorine and boron	K. L. Ramaswamy	<i>Proc Ind Acad. Sci.</i>	1935
19	Dielectric coefficients of gases and vapours, substituted methanes and ethanes, cyclopropane, ethylene oxide and benzene	K. L. Ramaswamy	<i>Proc Ind. Acad Sci</i>	1936
20	Refractive indices and dispersions of gases, substituted methanes and ethanes, cyclopropane, ethylene oxide and benzene.	K. L. Ramaswamy	<i>Proc. Ind Acad Sci</i>	1936
21	Structure of coumarin	M. A. Govinda Rao	<i>Curr Sci.</i>	1936
22	The dipole moment and structure of pyrones, 2-6 dimethyl pyrone, xanthone and coumarin	M. A. Govinda Rao	<i>Proc Ind Acad. Sci</i>	1936

23	The dipole moment and structure of some cyclic anhydrides, phthalic, succinic, citraconic anhydrides.	M. A. Govinda Rau and N. Ananthanarayanan	<i>Proc Ind Acad Sci.</i>	1937
24	Dielectric polarisation and form of carbon dioxide molecule.	K. L. Ramaswamy	<i>Curr Sci</i>	1937
25	Dielectric polarisation and form of carbon dioxide molecule.	K. L. Ramaswamy	<i>Proc Ind Acad Sci</i>	1937

## 9. RAMAN EFFECT

No.	Subject	Author	Journal	Year
1	A new radiation . . .	O V. Raman	<i>Ind. Jr Phy.</i>	1928
2	A new type of secondary radiation	O. V. Raman and K S Krishnan.	<i>Nature</i>	1928
3	A change of wave-length in light-scattering	O V Raman	<i>Nature</i>	1928
4	The optical analogue of the Compton effect	O V Raman and K. S Krishnan	<i>Nature</i>	1928
5	A new class of spectra due to secondary radiation, Part I	O V Raman and K S Krishnan	<i>Ind J., Phy</i>	1928
6	Polarisation of scattered light quanta	O. V Raman and K S Krishnan	<i>Nature</i>	1928
7	Rotation of molecules induced by light	O V Raman and K. S. Krishnan.	<i>Nature</i>	1928
8	Molecular spectra in the extreme infra-red.	O V Raman and K S Krishnan	<i>Nature</i>	1928
9	The negative absorption of radiation	O V. Raman and K S Krishnan	<i>Nature</i>	1928

10	The Raman effect in gases and vapours	L. A. Ramdas	<i>Ind Jr Phy</i>	1928
11	The Raman effect in crystals	I Ramakrishna Rao	<i>Ind Jr Phy</i>	1928
12	The Raman effect in crystals	K. S. Krishnan	<i>Nature</i>	1928
13	Influence of temperature on the Raman effect	K S Krishnan	<i>Nature</i>	1928
14	The production of new radiations by light-scattering, Part I	C V Raman and K S Krishnan.	<i>Proc Roy Soc</i>	1929
15	Bibliography of 150 papers on the Raman effect	A S Ganesan	<i>Ind Jr Phy</i>	1929
16	Raman effect in chemical constitution	S Venkateswaran	<i>Proc Inst. Chem India</i>	1929
17	Investigations of molecular structure by light-scattering	C V Raman	<i>Trans Far Soc</i>	1929
18	Raman spectra under high dispersion	W M Dabodghao	<i>Ind Jr Phy</i>	1930
19	Raman effect and molecular structure.	S Bhagavantam	<i>Ind Jr Phy</i>	1930
20	Polarisation of the lines in Raman spectra.	S Bhagavantam	<i>Ind Jr Phy</i>	1930

# RAMAN EFFECT—*Could.*

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No.	Subject	Author	Journal	Year
21	Influence of polymerisation and molecular association on the Raman effect.	S Bhagavantam	<i>Ind. Jr. Phy</i>	1930
22	Raman spectra of some elements and simple compounds	S. Bhagavantam	<i>Ind. Jr Phy.</i>	1930
23	Raman spectra of some tri-atomic molecules	S Bhagavantam	<i>Nature</i>	1930
24	Relation of Raman effect to crystal structure and properties of diamond	S Bhagavantam	<i>Ind. Jr. Phy</i>	1930
25	Further studies on the Raman spectrum of diamond	S. Bhagavantam	<i>Ind. Jr Phy.</i>	1930
26	The Raman effect Its significance for physics and chemistry.	S. Bhagavantam	<i>Ind. Jr. Phy</i>	1930
27	The molecular scattering of light	O. V. Raman	<i>Nobel Lecture</i>	1930
28	Raman spectra of gases.	S. Bhagavantam	<i>Nature</i>	1931
29	Effect of pressure on Raman spectra.	S. Bhagavantam	<i>Nature</i>	1931

30	Intensity of Raman scattering in gases	S. Bhagavantam	..	<i>Nature</i>	.	1931
31	Polarisation of Raman scattering by hydrogen gas	S Bhagavantam	.	<i>Nature</i>	.	1931
32	Raman effect in gases, Part I --- Experimental	S. Bhagavantam	.	<i>Ind Jr Phy</i>	.	1931
33	Raman effect in gases, Part II Some theoretical considerations	S Bhagavantam	.	<i>Ind. Jr Phy</i>	..	1931
34	Raman effect in gases, Part III Comparison of theory and experiment	S Bhagavantam	..	<i>Ind Jr Phy</i>	.	1931
35	Reversal of circular polarisation in Raman scattering	S Bhagavantam	.	<i>Ind Jr Phy</i>	.	1931
36	Evidence for the spin of the photon from light-scattering	C. V. Raman and S Bhagavantam	.	<i>Nature</i>	.	1931
37	Angular momentum of light	C. V. Raman	.	<i>Nature</i>	.	1931
38	Atoms and molecules as Fitzgerald oscillators	C V Raman	.	<i>Nature</i>	..	1931
39	Experimental proof of the spin of the photon	C V. Raman and S Bhagavantam	.	<i>Ind Jr. Phy.</i>	.	1931

## RAMAN EFFECT—Contd.

No.	Subject	Author	Journal	Year
40	A study of the Raman effect in amorphous solids.	S Bhagavantam	<i>Ind. Jr. Phys.</i>	1931
41	Raman spectra of the simpler hydrocarbons.	S Bhagavantam	<i>Ind. Jr. Phys.</i>	1931
42	Raman effect in calcite and aragonite.	S Bhagavantam	<i>Zeit. fur. Krist.</i>	1931
43	Experimental proof of the spin of the photon.	O V Raman and S. Bhagavantam	<i>Nature</i>	1932
44	Raman effect in gases, CO and NO	S. Bhagavantam	<i>Phys Rev.</i>	1932
45	Oscillations of the methane molecule.	S Bhagavantam	<i>Nature</i>	1932
46	Anomalous behaviour of methane in the Raman effect	S. Bhagavantam	<i>Nature</i>	1932
47	Evidence for a spinning photon, I. Intensity relations in the Raman spectrum of hydrogen	S Bhagavantam	<i>Ind. Jr. Phys.</i>	1932
48	Intensity relations in the Raman spectra of hydrogen, II.	S. Bhagavantam	<i>Ind. Jr. Phys.</i>	1933

49	The normal vibrations of molecules having tetrahedral-symmetry	N S Nagendra Nath	..	<i>Ind Jr. Phy</i>	.	1934
50	The normal vibrations of molecules having octahedral symmetry	N S Nagendra Nath	..	<i>Proc Ind Acad Sci</i>		1934



# 10. VISCOSITY OF LIQUIDS AND SURFACE FORCES

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No.	Subject	Author	Journal	Year
1	Curvature method for surface tension	C V Raman	<i>Phil. Mag.</i>	1907
2	On ripples of finite amplitude	J C Kameswara Ray	<i>Proc Ind Assoc Cult. Sci</i>	1921
3	Some experiments in ripple motion	G L Datta	<i>Asiat Mool. Sil Jub. Vol</i>	1922
4	On the oscillation of spheroidal drops and the phenomena of the spheroidal state	R N Ghosh	<i>Proc Ind Assoc. Cult Sci</i>	1922
5	The viscosity of liquids	C V Raman	<i>Nature</i>	1923
6	A theory of the viscosity of liquids	C V Raman	<i>Nature</i>	1923
7	Ripples of finite amplitude on a viscous liquid.	J C Kameswara Ray	<i>Calc Math Soc Bull</i>	1923
8	The scattering of light by liquid boundaries and its relation to surface tension, Part I.	C V. Raman and L. A Ramdas.	<i>Proc Roy Soc</i>	1925

9	The scattering of light by liquid boundaries and its relation to surface tension, Part II	C V Raman and L A Ramdas	<i>Proc Roy Soc</i>	..	1925
10	The scattering of light by liquid boundaries and its relation to surface tension, Part III.	C V. Raman and L A Ramdas.	<i>Proc. Roy Soc</i>		1925
11	On the origin of the movements of camphor on water and the allied phenomena	L A Ramdas	<i>Ind Jr Phy</i>	.	1926
12	The scattering of light by liquid surfaces	L A Ramdas	<i>Ind Jr Phy</i>	..	1927
13	The Maxwell effect in liquids	C V. Raman and K S Krishnan	<i>Nature</i>	..	1927
14	A theory of the birefringence induced by flow in liquids	C V Raman and K S Krishnan	<i>Phil Mag.</i>	.	1928
15	Are black soap films birefringent	K S Krishnan	<i>Ind Jr Phy.</i>	.	1929
16	The temperature variation of the viscosity of liquids and its theoretical significance	M P Venkatarama Iyer	<i>Ind Jr Phy</i>	.	1920
17	Diffraction of light by ripples on liquid surfaces, I.	D S. Subbaramayya	<i>Proc. Ind Acad Sci.</i>		1937

## 11. ULTRASONICS AND HYPERSONICS

No.	Subject	Author	Journal	Year
1	Examination of molecularly scattered light with a Fabry-Perot etalon, Part I—Liquid benzene.	B V Raghavendra Rao	<i>Proc. Ind. Acad. Sci.</i>	1934
2	Examination of molecularly scattered light with a Fabry-Perot etalon, Part II—Liquids, toluene and carbon tetrachloride	B V Raghavendra Rao	<i>Proc. Ind. Acad. Sci.</i>	1934
3	Nature of thermal agitation in liquids.	C. V Raman and B. V Raghavendra Rao.	<i>Nature</i>	1935
4	The Doppler effect in light-scattering by liquids, Part I—Variation with temperature.	B V. Raghavendra Rao	<i>Proc. Ind. Acad. Sci.</i>	1935
5	Doppler effect in light-scattering in liquids, Part II—Polarisation of the transversely scattered radiation	B V Raghavendra Rao	<i>Proc. Ind Acad. Sci.</i>	1935
6	The diffraction of light by high frequency sound waves, Part I	C V Raman and N. S. Nagendra Nath	<i>Proc. Ind. Acad. Sci.</i>	1935

7	The diffraction of light by high frequency sound waves, Part II	C V Raman and N S Nagendra Nath	<i>Proc. Ind Acad. Sci.</i>	1935
8	Determination of ultrasonic velocity in 52 liquids	S Parthasarathy	<i>Proc Ind Acad Sci.</i>	1935
9	The diffraction of light by high frequency sound waves, Part III —Doppler effect and coherence phenomena	C V Raman and N S Nagendra Nath	<i>Proc Ind. Acad. Sci</i>	1936
10	The diffraction of light by high frequency sound waves, Part IV —Generalised theory	C V Raman and N S. Nagendra Nath	<i>Proc Ind Acad Sci.</i>	1936
11	The diffraction of light by high frequency sound waves, Part V —General considerations (oblique incidence and amplitude changes)	C V Raman and N S Nagendra Nath	<i>Proc Ind Acad Sci</i>	1936
12	Ultrasonic velocities in some organic liquids, Part II	S Parthasarathy	<i>Proc Ind Acad Sci</i>	1936
13	Ultrasonic velocities in some organic liquids, Part III —Esters and ethers	S Parthasarathy	<i>Proc Ind Acad Sci</i>	1936
14	Ultrasonic velocities in some organic liquids, Part IV —Halo-gen compounds	S Parthasarathy	<i>Proc Ind Acad. Sci</i>	1936

# ULTRASONICS AND HYPERSONICS—Contd.

No.	Subject	Author	Journal	Year
15	Doppler effect in light scattering in liquids, Part III—Polarisation of light transversely scattered by ferriol and acetic acids	B. V. Raghavendra Rao	<i>Proc. Ind. Acad. Sci.</i>	1936
16	Resonance curves for a quartz oscillator immersed in liquids	S. Parthasarathy	<i>Proc. Ind. Acad. Sci.</i>	1936
17	Ultrasonic velocities in organic liquids, Part V:—Some related groups	S. Parthasarathy	<i>Proc. Ind. Acad. Sci.</i>	1936
18	Diffraction of light by ultrasonic waves	C. V. Raman and N. S. Nagendra Nath	<i>Nature</i>	1936
19	Ultrasonic velocities in organic liquids, Part VI—Related compounds	S. Parthasarathy	<i>Proc. Ind. Acad. Sci.</i>	1936
20	Diffraction of light by ultrasonic waves, Part I.	S. Parthasarathy	<i>Proc. Ind. Acad. Sci.</i>	1936
21	Diffraction of light by ultrasonic waves, Part II—Reflection and transmission phenomena	S. Parthasarathy	<i>Proc. Ind. Acad. Sci.</i>	1936

22	Dispersion of acoustic velocity in organic liquids	S Parthasarathy	<i>Proc. Ind. Acad. Sci.</i>	1936
23	Diffraction of light by ultrasonic waves—a test of polarisation	S Parthasarathy	<i>Curr. Sci.</i>	1936
24	The diffraction of light by high frequency sound waves Generalised theory—asymmetry of diffraction phenomena at oblique incidences	N S Nagendra Nath	<i>Proc. Ind. Acad. Sci.</i>	1936
25	On the visibility of ultrasonic waves	P Rama Pisharoty	<i>Proc. Ind. Acad. Sci.</i>	1936
26	A simple method of deriving the periodic visibility of ultrasonic waves	N S Nagendra Nath	<i>Proc. Ind. Acad. Sci.</i>	1936
27	The visibility of ultrasonic waves and its periodic variations	N S Nagendra Nath	<i>Proc. Ind. Acad. Sci.</i>	1936
28	Ultrasonic velocity in liquid mixtures	S Parthasarathy	<i>Proc. Ind. Acad. Sci.</i>	1936
29	On the visibility of ultrasonic waves in liquids	S Parthasarathy	<i>Curr. Sci.</i>	1936
30	On the visibility of ultrasonic waves in liquids	S Parthasarathy	<i>Proc. Ind. Acad. Sci.</i>	1936

# ULTRASONICS AND HYPERSONICS—Contd

No.	Subject	Author	Journal	Year
31	Acoustic spectrum of liquids	C V Raman and B V Raghavendra Rao	Nature	1937
32	Acoustic velocities in liquids	S Parthasarathy	Curr Sci	1937
33	Diffraction of ultrasonic waves, oblique incidence (in liquids)	S Parthasarathy	Curr Sci.	1937
34	Dispersion of sound velocity in liquids	S Parthasarathy	Curr Sci.	1937
35	Dispersion of sound velocity in liquids	B V Raghavendra Rao	Nature	1937
36	Sound velocity and chemical constitution.	S Parthasarathy	Curr Sci	1938
37	Light scattering and fluid vis- cosity	C V Raman and B V Raghavendra Rao.	Nature	1938

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No.	Subject	Author	Journal	Year
1	The spectrum of neutral helium	C V Raman	<i>Nature</i>	1922
2	On the spectrum of neutral helium	C V Raman and A. S. Ganesan	<i>Astro Phy Jr</i>	1923
3	On the fluorescence of didymium in glass	N C Krishnayar	<i>Proc Ind Assoc Cult Sci.</i>	1923
4	On the spectrum of neutral helium, II	C V Raman and A. S. Ganesan	<i>Astro Phy Jr</i>	1924
5	Anomalous dispersion and multiple lines in spectra	C V Raman and S K Datta	<i>Nature</i>	1925
6	The spectrum of potassium excited during the spontaneous combustion with chlorine	L A Ramdas	<i>Nature</i>	1925
7	The ultra-violet absorption bands of oxygen	A S Ganesan	<i>Ind Jr. Phy.</i>	1928
8	The spectrum of potassium excited during its spontaneous combustion with chlorine	L A Ramdas	<i>Ind. Jr Phy</i>	1928
9	High frequency spectrum of mercury vapour	N B Bhatt	<i>Proc Ind Acad. Sci.</i>	1934



No	Subject	Author	Journal	Year
10	A suggested new interpretation of the structure of band spectra	S Bhagavantam	<i>Proc Ind Acad Sci</i>	1935
11	The flame spectra of some aromatic compounds	W. M. Vaidyn	<i>Proc Ind. Acad Sci</i>	1935
12	The fluorescence of ruby, sapphire and emerald	C S Venkateswaran	<i>Proc. Ind Acad. Sci</i>	1935
13	Fluorescence in cyclohexane	R Padmanabhan	<i>Proc. Ind Acad Sci.</i>	1935
14	The fluorescence of acetone vapour	R. Padmannabhan	<i>Proc Ind Acad. Sci.</i>	1937
15	Flame spectra of some aliphatic halides Part I—Methyl iodide	W. M. Vaidyn	<i>Proc Ind. Acad. Sci.</i>	1937

# 13. RAMAN SPECTRA

No	Subject	Author	Journal	Year
1	The Raman effect and the spectrum of rodialcal light.	L A Ramdas	<i>Nature</i>	1928
2	A study of the Raman effect in glycerine and glycerine-water mixtures.	S Venkateswaran	<i>Ind Jr Phy</i>	1928
3	Raman effect in highly viscous liquids	S Venkateswaran	<i>Nature</i>	1928
4	Raman effect in carbon disulphide	A S Ganesan and S Venkateswaran	<i>Nature</i>	1929
5	A memoir of the Raman effect in liquids	A S Ganesan and S Venkateswaran	<i>Ind Jr Phy</i>	1929
6	The Raman effect in some organic liquids.	S Venkateswaran	<i>Phil Mag</i>	1929
7	Further investigation on the intensities of lines in Raman spectra	S C Sirkar	<i>Ind. Jr Phy</i>	1930
8	On the relative intensities of different Raman lines due to different exciting frequencies	S. C Sirkar	<i>Ind Jr. Phy</i>	1930

## RAMAN SPECTRA—Contd.

No	Subject	Author	Journal	Year
9	Forms of oscillation of the benzene ring in Raman effect.	S Bhagavantam	<i>Ind. Jr. Phy</i>	1930
10	On the intensities of the lines in Raman Spectra	S. C. Sirkar	<i>Ind. Jr. Phy.</i>	1930
11	The polarisation of Raman lines, some hydro-carbons.	S Bhagavantam	<i>Ind. Jr. Phy.</i>	1930
12	Interpretation of Raman spectra. Some aliphatic amines and alcohols.	S Venkateswaran and S. Bhagavantam	<i>Ind. Jr. Phy</i>	1930
13	Raman effect in some organo-metallo heterocyclic compounds	S Venkateswaran	<i>Ind. Jr. Phy</i>	1930
14	The Raman spectra of some organic halogen compounds.	S Bhagavantam and S Venkateswaran	<i>Proc. Roy Soc</i>	1930
15	The Raman spectra of some aldehydes and of mesitylene	S Venkateswaran and S Bhagavantam	<i>Proc. Roy Soc</i>	1930
16	Raman spectra of nitriles	S Venkateswaran	<i>Nature</i>	1930
17	Raman spectra of the nitriles	S Venkateswaran	<i>Ind. Jr. Phy.</i>	1930

18	Raman effect with optically active substances	S Bhagavantam and S Venkateswaran.	Nature	..	1930
19	Raman effect in liquid pyridine	S Venkateswaran	Jr Phy. Chem.	..	1930
20	Raman effect in hydrogen sulphide	S Bhagavantam	Nature	.	1930
21	Raman spectra of crystalline inorganic chlorides	P Krishnamurti	Ind Jr. Phy	..	1930
22	Raman spectra of inorganic crystals, Part II —Hydroxides, cyanides and sulpho-cyanides	P Krishnamurti	Ind Jr Phy	..	1930
23	Raman spectra of crystalline powders	P Krishnamurti	Nature		1930
24	Raman spectra of inorganic crystals, Part I —Substances containing $\text{XO}_2$ and $\text{XO}_4$ groups	P. Krishnamurti	Ind Jr Phy.	.	1930
25	Raman effect in paramagnetic crystals	P Krishnamurti	Nature		1930
26	Raman effect in some crystalline inorganic sulphates. Influence of paramagnetism on Raman lines	P Krishnamurti	Ind Jr Phy.	.	1930
27	Raman effect with cadmium arc excitation	P Krishnamurti	Ind Jr Phy.	.	1930

## RAMAN SPECTRA—Contd

No	Subject	Author	Journal	Year
28	Raman effect in metallic halides	P. Krishnamurti	<i>Nature</i>	1930
29	Raman spectra and infra-red absorption of sulphur	P. Krishnamurti	<i>Ind Jr Phy</i>	1930
30	The Raman effect in crystal powders of inorganic nitrates	P Krishnamurti	<i>Ind Jr Phy</i>	1930
31	Study of hydrolytic dissociation by Raman effect	P Krishnamurti	<i>Ind Jr. Phy</i>	1931
32	The Raman spectra of some inorganic chlorides	S Venkateswaran	<i>Ind. Jr Phy</i>	1931
33	The complete Raman spectrum in relation to infra-red absorption, Part I —Pyridine and acetic acid	P Krishnamurti	<i>Ind Jr Phy.</i>	1931
34	The complete Raman spectrum in relation to infra-red absorption, Part II —Benzene, cyclohexane and octane	P Krishnamurti	<i>Ind Jr Phy</i>	1931
35	Influence of exciting frequency on the intensities of lines in Raman spectra.	S C Sirkar	<i>Ind Jr Phy.</i>	1931

36	Raman spectra of some organic crystals and solutions	P Krishnamurti	..	<i>Ind Jr. Phy</i>	1931
37	The Raman spectrum of formic acid	S Parthasarathy	.	<i>Ind Jr. Phy.</i>	1931
38	Raman spectra of liquid mixtures	P. Krishnamurti	.	<i>Nature</i>	1931
39	Raman spectrum of hydrogen peroxide	S Venkateswaran	.	<i>Nature</i>	1931
40	Raman spectra of inorganic sulphides	S Venkateswaran	.	<i>Ind Jr Phy</i>	1931
41	Raman spectra of inorganic crystals, Part III	P Krishnamurti	.	<i>Ind Jr Phy.</i>	1931
42	Raman effect and formation of hydrates in solution	P Krishnamurti	..	<i>Ind Jr Phy</i>	1931
43	On the relative intensities of Stokes and anti-Stokes lines in the Raman spectrum	S C Sirkar	.	<i>Ind Jr Phy</i>	1931
44	Specific heat in relation to Raman effect data	S Paramasivan	.	<i>Ind Jr Phy</i>	1931
45	Raman effect in liquid carbon dioxide	S Bhagavantam	.	<i>Curr Sci</i>	1932
46	The infra-red and Raman spectra of carbon disulphide.	S Bhagavantam	.	<i>Phy Rev</i>	1932

# RAMAN SPECTRA—Contd

No	Subject	Author	Journal	Year
17	On the Raman spectra of diethyl methyl ether, diethyl ether and heptane	S C Sirkar	<i>Ind. Jr Phy</i>	1932
48	On the Raman spectra of piperidine, ethyl alcohol and acetone	S C Sirkar	<i>Ind Jr Phy</i>	1932
19	Raman spectra of iodides, Part I—Phosphonium iodide and methyl iodide	N G Pai	<i>Ind. Jr Phy</i>	1932
50	A bibliography of the Raman effect, 1930-32	S C Sirkar	<i>Ind. Jr. Phy.</i>	1932
51	Molecular rotation in liquids as revealed by Raman effect	S P Ranganadham	<i>Ind Jr. Phy</i>	1932
52	Polarisation of Raman lines in liquids	S Bhagavantam	<i>Ind Jr Phy</i>	1932
53	Polarisation of Raman scattering	S Bhagavantam and S Venkateswaran.	<i>Nature</i>	1932
54	Raman spectra of iodides, Part II—Ethyl, propyl and isobutyl iodides.	N G. Pai	<i>Ind Jr Phy.</i>	1932

55	Raman spectra of pinene, thio phenes, salol and thymol	S Venkateswari and S. Bhagavantam	<i>Ind. Jr. Phy.</i>	..	1932
56	On the influence of ultra-violet absorption in the relative intensi- ties of Stokes and anti-Stokes lines in the Raman spectra.	S C. Sirkar	<i>Ind Jr. Phy.</i>	..	1933
57	Effect of electric field on the polarisation of Raman lines.	S C Sirkar	<i>Ind Jr Phy</i>	.	1933
58	Dispersion of polarisation of Raman lines	S C. Sirkar	<i>Ind Jr Phy</i>	.	1933
59	Raman effect in the study of chemical reactions	S Parthasarathy	<i>Phil. Mag.</i>	.	1934
60	The Raman spectra of some metallic halides	C S Venkateswaran	<i>Proc Ind Acad Sci</i>	.	1934
61	Raman spectrum of sulphur in the solid and liquid states.	C S. Venkateswaran	<i>Proc. Ind Acad. Sci</i>	.	1934
62	The carbon isotope in Raman scattering	S Bhagavantam	<i>Proc. Ind Acad. Sci</i>	..	1935
63	The Raman spectra of iodic acid and alkaline iodates as solids and as solutions.	C S. Venkateswaran	<i>Proc. Ind. Acad. Sci</i>	.	1935
64	Raman spectrum of heavy water	R. Ananthakrishnan	<i>Nature</i>	..	1935



# RAMAN SPECTRA—Contd.

No.	Subject	Author	Journal	Year
65	Raman spectra of dioxane and tetralin.	O. S. Venkateswaran	<i>Proc Ind. Acad. Sci.</i>	1935
66	Raman spectra of isoprene, di-pentene and celinene.	P. S. Subhvaran	<i>Proc Ind. Acad. Sci.</i>	1935
67	Raman spectrum of phosphorus	O. S. Venkateswaran	<i>Proc. Ind. Acad. Sci.</i>	1935
68	Raman spectrum of heavy water	R. Ananthakrishnan	<i>Proc. Ind. Acad. Sci.</i>	1935
69	Raman spectra of some organic liquids under high dispersion and resolving power.	R. Ananthakrishnan	<i>Proc. Ind. Acad. Sci.</i>	1935
70	Note on the Raman spectra of metallic formates and the constitution of formic acid.	O. S. Venkateswaran	<i>Curr. Sci.</i>	1935
71	Raman spectra of some formates and the constitution of formic acid.	C. S. Venkateswaran	<i>Proc. Ind. Acad. Sci.</i>	1935
72	Some new features in the Raman spectra of carbon and silicon tetrachlorides.	R. Ananthakrishnan	<i>Proc Ind. Acad. Sci.</i>	1935

73	Effect of temperature on the Raman spectrum of carbon tetrachloride.	R Ananthakrishnan	<i>Curr. Sci</i>	1935
74	The Raman spectra of propylene and isobutane	R Ananthakrishnan	<i>Proc Ind Acad Sci</i>	1936
75	Raman spectrum of cyclopropane	R Ananthakrishnan	<i>Nature</i>	1936
76	Raman spectra of cyclopropane and ethylene oxide	R Ananthakrishnan	<i>Proc Ind Acad. Sci</i>	1936
77	Polarisation of the Raman bands of water and deuterium oxide	R Ananthakrishnan	<i>Proc Ind Acad Sci</i>	1936
78	Raman spectra of trimethylamine and some compounds of hydroxylamine and hydrazine	R. Ananthakrishnan	<i>Proc Ind Acad Sci.</i>	1936
79	The Raman spectra of crystalline selenious acid	C S Venkateswaran	<i>Curr Sci</i>	1936
80	The Raman spectrum of selenious acid and its sodium salts	C S Venkateswaran	<i>Proc Ind Acad Sci</i>	1936
81	The Raman spectrum and electrolytic dissociation of selenic acid	C S Venkateswaran	<i>Proc Ind Acad Sci</i>	1936
82	Raman spectra of sulphur and phosphorus, Part I—Polarisation and molecular structure	C S Venkateswaran	<i>Proc Ind Acad Sci.</i>	1936

# RAMAN SPECTRA—Contd.

No.	Subject	Author	Journal	Year
83	Raman spectra of sulphur and phosphorus, Part II—lattice oscillations.	C. S. Venkateswaram	Proc. Ind. Acad. Sci.	1936
84	The Raman spectra of ortho phosphoric acid and same phosphates.	C. S. Venkateswaram	Proc. Ind. Acad. Sci.	1936
85	Polarisation of Raman lines in some inorganic solids.	C. S. Venkateswaram	Proc. Ind. Acad. Sci.	1936
86	Constitution of the phosphon (acid and phosphites).	R. Ananthakrishnan	Nature	1936
87	The Raman spectra of some boron compounds (methyl borate, ethyl borate, boron trihalides and boric acid).	R. Ananthakrishnan	Proc. Ind. Acad. Sci.	1936
88	A new technique of elementary filters for photographing the Raman spectra of crystal powders.	R. Ananthakrishnan	Curr. Sci.	1936
89	Raman spectra of crystal powders, 1.—Halides and sulphates of ammonium.	R. Ananthakrishnan	Proc. Ind. Acad. Sci.	1937

90	Raman spectra of crystal powders, Part II.—The chlorides and sulphates of hydroxylamine and hydrazine	R Ananthakrishnan	<i>Proc Ind. Acad. Sci</i>	1937
91	Raman spectra of crystal powders, Part III.—Exchange reactions, Ammonium chloride and heavy water	R Ananthakrishnan	<i>Proc Ind Acad Sci</i>	1937
92	Raman spectra and constitution of $\text{NO}_3$ ion	R Ananthakrishnan	<i>Curr Sci.</i>	1937
93	Raman spectra of crystal powders, Part IV.—Some organic and inorganic compounds	R Ananthakrishnan	<i>Proc Ind Acad Sci</i>	1937
94	Raman spectra of some simple molecules (Dimethyl ether, phosgene, normal butane, ethylene diamine, ethylene glycol, ethylene dichloride, ethylene dibromide, acetylene tetrachloride acetylene tetrabromide and hexachloro ethane)	R Ananthakrishnan	<i>Proc Ind Acad Sci</i>	1937
95	Raman spectra of crystal powders, Part V.—Inorganic nitrates and water of crystallisation	R Ananthakrishnan	<i>Proc Ind Acad Sci</i>	1937
96	Raman effect and molecular structure	C S Venkateswaran	<i>Curr Sci</i>	1937

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No	Subject	Author	Journal	Year
97	O-II Raman frequency in organic acids	O S Venkateswarann	<i>Nature</i>	1937
98	The physical identity of onan tioneers, Part IV —Raman spectre of <i>dextro</i> and <i>levo</i> camphor acids and camphoric anhydrides	B K Singh and B Misa	<i>Proc Ind. Acad. Sci</i>	1937
99	Raman spectre of <i>dextro</i> , <i>levo</i> , and racemic forms of borneol and camphor	B V Thosar and B K Singh	<i>Proc Ind. Acad. Sci</i>	1937
100	Note on the intensity of Raman lines in crystals	O. S Venkateswarann	<i>Curr Sci</i>	1937
101	Raman spectre of some diacylanones	B V Thosar	<i>Zeit. f. Phys.</i>	1937
102	Raman spectrum of coumarone	O. S Venkateswarann	<i>Curr Sci.</i>	1938
103	The existence of hydroxyl frequency in Raman spectre of acids and acid salts	O S Venkateswarann	<i>Proc Ind Acad Sci</i>	1938
104	Nature of lattice oscillations in carbon dioxide	O S Venkateswarann	<i>Curr Sci</i>	1938
105	The Raman spectra of some inorganic compounds	O S Venkateswarann	<i>Proc Ind Acad Sci</i>	1938

# 14 OPTICAL AND ELASTIC PROPERTIES OF SOLIDS

No	Subject	Author	Journal	Year
1	The photographic study of impact at minimal velocities	C V Raman	<i>Phy Rev</i>	1918
2	Experiments on impact	A Venkatasubbaraman	<i>Proc Ind Assoc Cult Sci</i>	1920
3	Percussion figures in isotropic solids	C V Raman	<i>Nature</i>	1920
4	Some applications of Hertz's theory of impact.	C V Raman	<i>Phy Rev</i>	1920
5	Theory of impact on elastic plates	K Seshagiri Rao	<i>Proc Ind Assoc Cult Sci</i>	1921
6	Smoky quartz	C V. Raman	<i>Nature</i>	1921
7	Conical refraction in biaxial crystals	C V Raman	<i>Nature</i>	1921
8	On a new optical property of biaxial crystals	C V Raman and V S Tamma	<i>Phil Mag</i>	1922
9	Deformation of the Rings and Brushes as observed through a spath hemitrope	B N Chuckerbutti	<i>Phil Mag</i>	1922

## OPTICAL AND ELASTIC PROPERTIES OF SOLIDS—Contd.

No.	Subject	Author	Journal	Year
10	Colours of chlorate of potash	L. A. Randles	<i>Proc. Ind. Assoc. Cult. Sci.</i>	1923
11	The electron theory of solids and the rigidity of metals	D. Banerji	<i>Proc. Ind. Assoc. Cult. Sci.</i>	1923
12	The optical properties of amethyst quartz.	C. V. Raman and K. Banerji	<i>Trans. Opt. Soc. London</i>	1925
13	The effect of dispersion on the interference figures of crystals	C. V. Raman	<i>Nature</i>	1925
14	The birefringence of crystalline carbonates, nitrates and sulphates.	C. V. Raman	<i>Nature</i>	1926
15	On the permanent deformation produced by contact of solids	K. Banerji	<i>Ind. Jr. Phy.</i>	1926
16	Theory of photoelasticity	K. Banerji	<i>Ind. Jr. Phy.</i>	1927
17	Raman effect, fluorescence and colour of diamonds	S. Bhagavantam	<i>Nature</i>	1930
18	Cathode luminescence of diamond	M. V. John	<i>Ind. Jr. Phy.</i>	1931
19	Optical properties of some amorphous crystals.	K. L. Narasimham	<i>Ind. Jr. Phy.</i>	1931

20	The origin of the colours in the plumage of birds	C V Raman	<i>Proc Ind Acad Sci</i>	1934
21	On iridescent shells, Part I — Introductory	C V Raman	<i>Proc Ind Acad Sci.</i>	1934
22	On iridescent shells, Part II — Colours of laminar diffraction	C V Raman	<i>Proc Ind Acad Sci</i>	1934
23	On iridescent shells, Part III — Body colours and diffusion haloes	C V Raman	<i>Proc Ind Acad Sci</i>	1934
24	The dynamical theory of the diamond lattice, Part I	N S Nagendra Nath	<i>Proc Ind Acad Sci</i>	1934
25	Hindered rotation and oscillation of molecules in liquids and crystals	S Bhagavantam	<i>Proc Ind Acad Sci</i>	1935
26	The dynamical theory of the diamond lattice, Part II — The elastic constants of diamond.	N S Nagendra Nath	<i>Proc Ind Acad Sci</i>	1935
27	The dynamical theory of the diamond lattice, Part III — The diamond-graphite transformation	N S Nagendra Nath	<i>Proc Ind Acad Sci</i>	1935
28	The structure and optical properties of nacre in iridescent shells, Part I.	V S Rajagopalan	<i>Proc. Ind. Acad. Sci</i>	1936
29	The elastic properties of mother-of-pearl	P S. Srinivasan	<i>Proc. Ind Acad. Sci</i>	1937



## 15. MISCELLANEOUS

	Subject	Author	Journal	Year
1	The free and forced convection from heated cylinders in air	B. B. Ray	<i>Proc. Ind. Assoc. Cult. Sci.</i>	1920
2	On the thermographic determination of acceleration of gravity.	D. Banerji	<i>Proc. Ind. Assoc. Cult. Sci.</i>	1922
3	An optical study of free and forced convection from thin heated wires in air.	S. C. Pramanik	<i>Proc. Ind. Assoc. Cult. Sci.</i>	1922
4	Compressibilities of aqueous solutions of some fatty acids.	S. Venkateswaram	<i>Jr. Phys. Chem.</i>	1927
5	Piezoelectric indices in corallites.	C. Mahadevan	<i>Ind. J. Phys.</i>	1927
6	A relation between the specific heat, thermal expansion and velocity of sound in liquids.	B. N. Srinivasan	<i>Ind. J. Phys.</i>	1927
7	Constitution of coal	C. Mahadevan	<i>Proc. Ind. Chem. India</i>	1929
8	Piezoelectric giant hysteresis in corallites.	M. S. Kalam and O. Mahadevan.	<i>Ind. J. Phys.</i>	1930
9	Investigations on porous ligatures and antibiotic coils.	O. Mahadevan	<i>Ind. J. Phys.</i>	1933
10	A convenient and rapid method for determining compressibilities of gases.	K. L. Ramaswamy	<i>Curr. Sci.</i>	1937

